

Notice of Allowability

Application No.

10/534,354

Applicant(s)

SUGITA ET AL.

Examiner

Erica E. Cadugan

Art Unit

3722

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to election filed 7/13/07 and interview of 7/26/07.
2. ☒ The allowed claim(s) is/are 1-14 and 29-38.
3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☒ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 5. ☒ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☒ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date See Continuation Sheet
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____

Continuation of Attachment(s) 3. Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date: 7/27/07, 2/27/07, 5/9/05.

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Mr. Jeffrey Schmidt on July 26, 2007.

The application has been amended as follows:

In the specification, the abstract has been amended as follows:

ABSTRACT

An object of the invention is to provide a spindle apparatus which facilitates assembling and removing operations at the time of maintenance and which is low cost. In the invention, the diameter becomes smaller in the order of an inner peripheral diameter of an outer cylinder (3), an inside diameter of a stator (4), and an outside diameter of a bearing sleeve (11); a sub-assembly (2) made up of a front housing (8), a rotating shaft (6), and the bearing sleeve (11) is withdrawable from the outer cylinder (3); and the diameter of a rotating part in an arbitrary section located rearwardly of the bearing sleeve (11) is made smaller than a minimum diameter of a non-rotating part between a rear end of the bearing sleeve (11) and the section.

[In the invention, the diameter becomes smaller in the order of an inner peripheral diameter of an outer cylinder (3), an inside diameter of a stator (4), and an outside diameter of a bearing sleeve (11); a sub-assembly (2) made up of a front housing (8), a rotating shaft (6), and the bearing sleeve (ii) is withdrawable from the outer cylinder (3); and the diameter of a rotating

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part in an arbitrary section located rearwardly of the bearing sleeve (11) is made smaller than a minimum diameter of a non-rotating part between a rear end of the bearing sleeve (11) and the section.]

In the specification, the following changes have been made: (note that page and line numbers refer to those appearing the substitute specification filed November 15, 2005)

On page 10, lines 2-3, "claim 1" has been changed to --the present invention--.

On page 10, line 22, "claim 2" has been changed to --the present invention--.

On page 11, lines 13-14, "claim 3" has been changed to --the present invention--.

On page 11, lines 18-19, "claim 4" has been changed to --the present invention--.

On page 11, the last two lines, "claim 5" has been changed to --the present invention--.

On page 12, lines 2-3, "claim 6" has been changed to --the present invention--.

On page 12, lines 6-7, "claim 7" has been changed to --the present invention--.

On page 12, lines 10-11, "claim 8" has been changed to --the present invention--.

On page 12, lines 15-16, "claim 9" has been changed to --the present invention--.

On page 12, lines 22-23, "claim 10" has been changed to --the present invention--.

On page 12, last line, "claim" has been deleted.

On page 13, line 1, "11" has been changed to --the present invention--.

On page 13, lines 2-3, "claim 12" has been changed to --the present invention--.

On page 13, lines 4-5, "claim 13" has been changed to --the present invention--.

On page 13, line 7, "claim 14" has been changed to --the present invention--.

On page 13, line 10, "claim 15" has been changed to --the present invention--.

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On page 14, lines 1-2, "claim 16" has been changed to --the present invention--.

On page 14, lines 6-7, "claim 17" has been changed to --the present invention--.

On page 14, lines 9-10, "claim 18" has been changed to --the present invention--.

On page 14, lines 15-16, "claim 19" has been changed to --the present invention--.

On page 14, line 21, "claim 20" has been changed to --the present invention--.

On page 15, line 12, "claim 21" has been changed to --the present invention--.

On page 16, line 1, "claim 22" has been changed to --the present invention--.

On page 16, line 5, "claim 23" has been changed to --the present invention--.

On page 16, lines 23-24, "claim 24" has been changed to --the present invention--.

On page 17, lines 1-2, "claim 25" has been changed to --the present invention--.

On page 17, lines 5-6, "claim 26" has been changed to --the present invention--.

On page 17, lines 9-10, "claim 27" has been changed to --the present invention--.

On page 17, lines 13-14, "claim 28" has been changed to --the present invention--.

On page 34, line 21, "corresponding to claims 1, 2, 5, 6, 10, 11, 12, 13, and 14" has been deleted.

On page 39, penultimate line, "corresponding to claims 1, 2, 3, 4, 5, 10, 11, 12, 13, and 14" has been deleted.

On page 46, line 14, "corresponding to claims 1, 2, 4, 5, 8, 10, 11, 12, 13, and 14" has been deleted.

On page 49, lines 17-18, "corresponding to claims 1, 2, 4, 5, 6, 7, 9, 10, 11, 12, 13, and 14" has been deleted.

On page 55, line 8, "corresponding to claims 15, 16, 17, 18, and 19" has been deleted.

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On page 67, line 20, "corresponding to claim 20" has been deleted.

On page 71, line 11, "corresponding to claim 21" has been deleted.

On page 75, line 13, "corresponding to claim 22" has been deleted.

On page 77, line 12, "corresponding to claims 23, 24, 25, 26, and 28" has been deleted.

On page 85, line 18, "corresponding to claims 23 and 27" has been deleted.

On page 90, lines 16-17, "described in claim 1" has been deleted.

On page 92, lines 2-3, "described in claim 2" has been deleted.

On page 92, last line, "described in" has been deleted.

On page 93, line 1, "claim 3" has been deleted.

On page 93, lines 9-10, "described in claim 4" has been deleted.

On page 93, lines 22-23, "described in claim 5" has been deleted.

On page 94, lines 5-6, "described in claim 6" has been deleted.

On page 94, lines 14-15, "described in claim 7" has been deleted.

On page 94, last two lines, "described in claim 8" has been deleted.

On page 95, lines 10-11, "described in claim 9" has been deleted.

On page 96, lines 2-3, "described in claim 10" has been deleted.

On page 96, lines 9-10, "described in claim 11" has been deleted.

On page 96, lines 14-15, "described in claim 12" has been deleted.

On page 96, lines 20-21, "described in claim 13" has been deleted.

On page 97, lines 5-6, "described in claim 14" has been deleted.

On page 97, lines 13-14, "described in claim 15" has been deleted.

On page 98, lines 3-4, "described in claim 16" has been deleted.

On page 98, lines 14-15, "described in claim 17" has been deleted.

On page 99, lines 2-3, "described in claim 18" has been deleted.

On page 99, lines 14-15, "described in claim 19" has been deleted.

On page 100, lines 6-7, "described in claim 20" has been deleted.

On page 100, lines 21-22, "described in claim 21" has been deleted.

On page 101, lines 9-10, "described in claim 22" has been deleted.

On page 101, lines 20-21, "described in claim 23" has been deleted.

On page 102, lines 13-14, "described in claim 24" has been deleted.

On page 102, lines 20-21, "described in claim 25" has been deleted.

On page 103, lines 6-7, "described in claim 26" has been deleted.

On page 103, lines 16-17, "described in claim 27" has been deleted.

On page 104, lines 2-3, "described in claim 28" has been deleted.

Claim 1 (Currently Amended). A spindle apparatus comprising:

an outer cylinder having a stator;

a rotatable rotating shaft having a rotor;

a front side bearing having an outer ring fixed to a front housing and an inner ring fitted over one end of the rotating shaft;

a bearing sleeve disposed on another end side of the rotating shaft and fitted in the outer cylinder so as to be movable in an axial direction of the rotating shaft; and

a rear side bearing having an inner ring fitted over the other end of the rotating shaft and an outer ring fixed to the bearing sleeve to rotatably support the rotating shaft in cooperation with the front side bearing,

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wherein the diameter becomes smaller in the order of an inner peripheral diameter of the outer cylinder, an inside diameter of the stator, and an outside diameter of the bearing sleeve,

wherein a sub-assembly made up of the front housing, the rotating shaft, and the bearing sleeve is withdrawable from the outer cylinder, [and]

wherein a radius of a rotating part in an arbitrary section located rearwardly of the bearing sleeve is smaller than a minimum radius of a non-rotating part between a rear end of the bearing sleeve and the section, and

wherein the front housing is fitted to the outer cylinder with an interference fit.

Claim 2 (Currently Amended). A spindle apparatus comprising:

an outer cylinder having a stator;

a rotatable rotating shaft having a rotor;

a front side bearing having an outer ring fixed to a front housing and an inner ring fitted over one end of the rotating shaft;

a bearing sleeve disposed on another end side of the rotating shaft and fitted in the outer cylinder so as to be movable in an axial direction of the rotating shaft; and

a rear side bearing having an inner ring fitted over the other end of the rotating shaft and an outer ring fixed to the bearing sleeve to rotatably support the rotating shaft in cooperation with the front side bearing,

wherein a sub-assembly made up of the front housing, the rotating shaft, and the bearing sleeve is withdrawable from the outer cylinder, and

an inside diameter part capable of [replacing] clamping and unclamping a tool is incorporated in the rotating shaft, and a piston mechanism for tool replacement is provided, and

wherein the front housing is fitted to the outer cylinder with an interference fit.

Claim 3 (Original). The spindle apparatus according to claim 2, wherein a distance between a mounting reference plane of the sub-assembly and a piston pressing surface of the inside diameter part is adjusted to within ± 0.1 mm relative to a reference dimension.

Claim 4 (Currently Amended). The spindle apparatus according to claim [2] 3, wherein the inside diameter part is incorporated in such a manner as to be capable of compressing a spring, and an adjustment part is fixed to a rear portion of the inside diameter part, the piston pressing surface for pressing the piston mechanism being formed on the adjustment part.

Claim 5 (Currently Amended). The spindle apparatus according to claim 1 4, wherein the front housing is fitted into the outer cylinder with [an] the interference fit.

Claim 6 (Original). The spindle apparatus according to claim 1, wherein the bearing sleeve is fitted in a sleeve housing, and an outside diameter of the bearing sleeve is clearance-fitted with respect to an inside diameter of the sleeve housing.

Claim 7 (Original). The spindle apparatus according to claim 6, wherein a plurality of pairs of O-rings are interposed between the outside diameter of the bearing sleeve and the inside diameter of the sleeve housing.

Claim 8 (Currently Amended). The spindle apparatus according to claim [1] 6, wherein a ratio between a fitting length of the bearing sleeve and the sleeve housing, and an outside diameter of the bearing sleeve is set within a range of fitting length[/outside diameter=0.45 to 0.8] to outside diameter equal to between 0.45 and 0.8.

Claim 9 (Original). The spindle apparatus according to claim 1, wherein

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there are provided a plurality of lubricant discharging holes provided circumferentially in the bearing sleeve, circumferential grooves provided in a fitting surface of an outer periphery of the bearing sleeve, and radial lubricant supplying passages communicatively connected to the circumferential grooves.

Claim 10 (Currently Amended). The spindle apparatus according to claim 1, wherein the rear side bearing is arranged in a back-to-back arrangement with a second rear side angular contact ball bearing with fixed-position preload.

Claim 11 (Original). The spindle apparatus according to claim 1, wherein grease lubrication is adopted.

Claim 12 (Original). The spindle apparatus according to claim 1, further comprising:
a grease replenishing unit.

Claim 13 (Currently Amended). The spindle apparatus according to claim [1] 11, wherein a mechanism is provided for discharging excess grease after the supply of grease.

Claim 14 (Currently Amended). The spindle apparatus according to claim 1, wherein [a very small] an amount of lubrication of any one of oil-air, oil-mist, and direct-injection lubrication is used.

Non-elected claims 15-28 have been canceled.

Claim 29 (Currently Amended). The spindle apparatus according to claim 2, wherein the front housing is fitted into the outer cylinder with [an] the interference fit.

Claim 30 (Previously Presented). The spindle apparatus according to claim 2, wherein the bearing sleeve is fitted in a sleeve housing, and

an outside diameter of the bearing sleeve is clearance-fitted with respect to an inside diameter of the sleeve housing.

Claim 31 (Currently Amended). The spindle apparatus according to claim [6] 30, wherein

a plurality of pairs of O-rings are interposed between the outside diameter of the bearing sleeve and the inside diameter of the sleeve housing.

Claim 32 (Currently Amended). The spindle apparatus according to claim [2] 30, wherein

a ratio between a fitting length of the bearing sleeve and the sleeve housing, and an outside diameter of the bearing sleeve is set with a range of fitting length[/outside diameter=1.45 to 0.8] to outside diameter equal to 0.45 to 0.8.

Claim 33 (Previously Presented). The spindle apparatus according to claim 2, wherein there are provided a plurality of lubricant discharging holes provided circumferentially in the bearing sleeve, circumferential grooves provided in a fitting surface of an outer periphery of the bearing sleeve, and radial lubricant supplying passages communicatingly connected to the circumferential grooves.

Claim 34 (Currently Amended). The spindle apparatus according to claim 2, wherein the rear side bearing is arranged in a back-to-back arrangement with a second rear side angular contact ball bearing with fixed-position preload.

Claim 35 (Previously Presented). The spindle apparatus according to claim 2, wherein grease lubrication is adopted.

Claim 36 (Previously Presented). The spindle apparatus according to claim 2, further comprising:

a grease replenishing unit.

Claim 37 (Currently Amended). The spindle apparatus according to claim [2] 35, wherein

a mechanism is provided for discharging excess grease after the supply of grease.

Claim 38 (Currently Amended). The spindle apparatus according to claim 2, wherein [a very small] an amount of lubrication of any one of oil-air, oil-mist, and direct-injection lubrication is used.

Non-elected claims 39-40 have been canceled.

2. The following changes to the drawings have been approved by the examiner and agreed upon by applicant: the label "Prior Art" has been added to Figure 31 (in accordance with the description thereof as "conventional" in the specification on page 1 as well as in the brief description of the drawings). In order to avoid abandonment of the application, applicant must make these above agreed upon drawing changes.

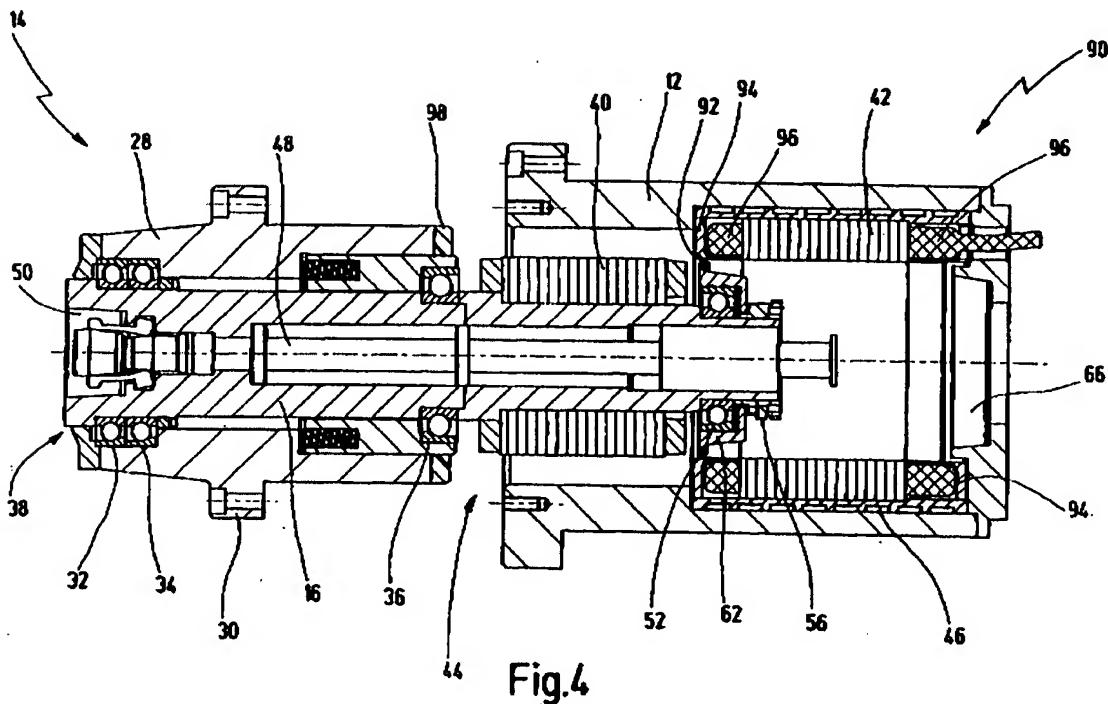
3. The following is an examiner's statement of reasons for allowance:

DE 10027750 (hereinafter, DE '750) teaches a "spindle apparatus" 10 including an "outer cylinder" 12 having a "stator" 42, a "rotatable rotating shaft" 16 having a "rotor" 40, a "front side bearing" 32/34 having an outer ring fixed to a front housing 28 and an inner ring fitted over an end of the shaft 16 (see Figure 1, for example). Also, a "bearing sleeve" 62 is disposed on the other end of the shaft 16 and is fitted in the outer cylinder 12 so as to be movable axially (see Figure 4, for example). "Rear side bearing" 52 has an inner ring fitted over the right (as viewed

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in Figure 1) end of the shaft 16 and an outer ring fixed to the bearing sleeve 62 to rotatably support shaft 16 (see Figures 1-4).

Re the diameters set forth in claim 1, see the reproduction of Figure 4 below, noting that the inner diameter of the outer cylinder 12 is larger than the inner diameter of the stator 42, and that the inner diameter of the stator 42 is larger than the outside diameter of the bearing sleeve 62.



Note also that a subassembly including the front housing 28, the rotating shaft 16, and the bearing sleeve 62 is withdrawable from the outer cylinder 12, as shown in at least Figures 2 and 4, for example.

Also, measuring gear wheel 56 is located rearwardly of the bearing sleeve 62, rotates (by virtue of its being a measuring gear and also being affixed to the rotating shaft 16, see Figure 4, 1, and English translation), has a smaller radius than the smallest or minimum radius of a non-rotating part located between the rear end of the bearing sleeve 62 and the section through the gear 56 (see Figure 1, for example, noting that the radius of the gear 56 is smaller than the minimum radius of any number of non-rotating parts located at a section of the gear, such as part 66, or the stator 42, for example, see Figure 1).

Additionally, re claim 2, DE '750 teaches an "inside diameter part" in the form of tool clamping system 48 incorporated in the shaft 16, and also teaches a hydraulic release unit 60 therefor for enabling tool replacement to occur at the working end 38 of the spindle.

However, in DE '750, the "front housing" 28 is bolted via bolts 26 to the "outer cylinder" 12. DE '750 does not teach that "the front housing is fitted to the outer cylinder with an interference fit" as set forth in each of independent claims 1 and 2.

Furthermore, it is noted that it appears that the whole point of the design of DE '750's device (re the subassembly, etc.) is to achieve ease of maintenance or repair by enabling a mechanic to easily be able to remove the subassembly described previously (see English abstract as well as the fourth and fifth paragraphs on page 1 of the machine English translation, for example). It is also noted that if an interference fit is used instead of (or in addition to) the bolts 26 to attach the front housing and thus the subassembly to the outer cylinder 12, such would make local (i.e., in place, as is desired as mentioned in DE '750 in the 4th and 5th paragraphs of the machine translation described above) repairs more difficult, as special equipment and or additional manpower would then be required to separate the front housing and subassembly from

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the outer cylinder 12. Thus, to modify DE '750's device by providing an interference fit between the front housing and the outer cylinder would appear to preclude DE '750's device from functioning as intended, i.e., to be able to be repaired locally and easily.

If the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). See also MPEP section 2143.01.

Thus, for at least the foregoing reasoning, DE '750 neither anticipates nor renders obvious the present invention as set forth in independent claims 1 and 2.

A similar situation exists with JP-2003-159622 (note that U.S. Patent Application Publication No. 2004/0074074 is in the same family as JP '622 and is thus being considered an English language equivalent thereto). Note that front housing 23 is detachably connected to the "outer cylinder" 25 via bolts 27 (see Figure 1 and paragraph 0033 of the U.S. '074 reference), rather than an interference fit. Further note that JP '622 also teaches that easy replacement of the spindle is desirable (paragraph 001 of the U.S. '074 reference), and further teaches away from using an interference fit, stating that such "requires expert knowledge and skill and a special facility and therefore, cannot be conducted at a site where the machine tool is used" (see U.S. '074 reference, paragraph 008, for example).

Thus, to modify JP '622's device by providing an interference fit between the front housing and the outer cylinder would appear to preclude JP '622's device from functioning as intended, i.e., to be able to be repaired locally and easily.

If the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). See also MPEP section 2143.01.

Thus, for at least the foregoing reasoning, JP '622 neither anticipates nor renders obvious the present invention as set forth in independent claims 1 and 2.

Additionally, the aforedescribed prior art being representative of the closest prior art of record, for at least the foregoing reasoning, the prior art of record neither anticipates nor renders obvious the present invention as set forth in independent claims 1 and 2.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

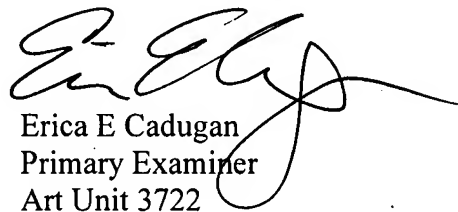
4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erica E. Cadugan whose telephone number is (571) 272-4474. The examiner can normally be reached on M-F, 6:30 a.m. to 4:00 p.m., alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Monica S. Carter can be reached on (571) 272-4475. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Erica E Cadugan
Primary Examiner
Art Unit 3722

eec
July 31, 2007

Approved
EEC
7/31/07

FIG. 31

Prior Art

